

In the Claims

1-21 (Cancelled).

1 22. (Previously presented) A process of converting a polymeric silsesquioxane into a POSS
2 fragment, comprising:

3 mixing an effective amount of a base with the polymeric silsesquioxane in a solvent to
4 produce a basic reaction mixture, the base reacting with the polymeric silsesquioxane to produce
5 the POSS fragment,

6 wherein the polymeric silsesquioxane has the formula $[\text{RSiO}_{1.5}]_{\infty}$, and the POSS fragment
7 has the formula $[(\text{RSiO}_{1.5})_m(\text{RXSiO}_{1.0})_n]$, where R represents an organic substituent, X represents
8 a functionality substituent, ∞ represents the degree of polymerization and is a number greater
9 than or equal to 1, and m and n represent the stoichiometry of the formula.

1 23. (Previously presented) The process of claim 22, wherein the base and the polymeric
2 silsesquioxane are mixed by stirring the reaction mixture.

1 24. (Previously presented) The process of claim 22, further comprising the steps of:
2 heating the reaction mixture to reflux; and
3 cooling the reaction mixture to room temperature.

1 25. (Previously presented) The process of claim 24, further comprising isolating the POSS
2 fragment.

1 26. (Previously presented) The process of claim 25, wherein the POSS fragment is isolated
2 by distillation, filtration, evaporation, decantation, crystallization, pressure reduction, or
3 extraction, or a combination thereof.

1 27. (Previously presented) The process of claim 26, further comprising the step of purifying
2 the isolated POSS fragment through washing with water.

1 28. (Previously presented) The process of claim 22 wherein the base cleaves at least one
2 silicon-oxygen-silicon (Si-O-Si) bond in the polymeric silsesquioxane to promote the conversion
3 of the polymeric silsesquioxane into the POSS fragment.

1 29. (Currently amended) The process of claim 28, wherein the base is selected from the
2 group consisting of hydroxide, organic alkoxides, carboxylates, amides, carboxamides,
3 carbanions, carbonate, sulfate, phosphate, biphosphate, phosphorus ylides, nitrate, borate,
4 cyanate, fluoride, hypochlorite, silicate, stannate, Al_2O_3 , CaO, and ZnO, amines, amine oxides,
5 lithium organometallics, zinc organometallics, and magnesium organometallics. $\text{hydroxide } [\text{OH}]^-$
6 ~~, organic alkoxides $[\text{R}''\text{O}]^-$, carboxylates $[\text{R}''\text{COO}]^-$, amides $[\text{R}''\text{NH}]^-$, carboxamides~~
7 ~~$[\text{R}''\text{C}(\text{O})\text{NR}'']^-$, carbanions $[\text{R}'']^-$, carbonate $[\text{CO}_3]^{2-}$, sulfate $[\text{SO}_4]^{2-}$, phosphate $[\text{PO}_4]^{3-}$,~~
8 ~~biphosphate $[\text{HPO}_4]^{2-}$, phosphorus ylides $[\text{R}''_4\text{P}]^-$, nitrate $[\text{NO}_3]^-$, borate $[\text{B}(\text{OH})_4]^-$, cyanate~~
9 ~~$[\text{OCN}]^-$, fluoride $[\text{F}]^-$, hypochlorite $[\text{OCl}]^-$, silicate $[\text{SiO}_4]^{4-}$, stannate $[\text{SnO}_4]^{4-}$, basic metal oxides~~
10 ~~comprising Al_2O_3 , CaO, and ZnO, amines $\text{R}''_3\text{N}$ and amine oxides $\text{R}''_3\text{NO}$, and organometallics~~
11 ~~comprising $\text{R}''\text{Li}$, $\text{R}''_2\text{Zn}$, $\text{R}''_2\text{Mg}$, and $\text{R}''\text{MgX}'$, where R'' represents an organic substituent and~~
12 ~~multiple organic substituents need not be identical, and X' represents an inorganic substituent.~~

1 30. (Previously presented) The process of claim 22, wherein a mixture of different bases is
2 used.

1 31. (Previously presented) The process of claim 22, further comprising mixing a co-reagent with
2 the base and the polymeric silsesquioxane in the solvent.

1 32. (Currently amended) The process of claim 31, wherein the co-reagent is selected from the
2 group consisting of common Grignard reagents, ~~$\text{R}''\text{MgX}'$~~ , alkali halides, zinc compounds
3 comprising ZnI_2 , ZnBr_2 , ZnCl_2 , and ZnF_2 , aluminum compounds comprising Al_2H_6 , LiAlH_4 ,
4 AlI_3 , AlBr_3 , AlCl_3 , and AlF_3 , and boron compounds comprising dihydroxy-organoborons,
5 ~~$\text{R}''\text{B}(\text{OH})_2$, BI_3 , BBr_3 , BCl_3 , and BF_3 .~~ ~~, where R'' represents an organic substituent and X'~~
6 ~~represents an inorganic substituent.~~

Claims 33-45 (Cancelled).

1 46. (Previously presented) A process of converting a plurality of POSS fragments into a
2 POSS compound, comprising:

3 mixing an effective amount of a base with the plurality of POSS fragments in a solvent to
4 produce a basic reaction mixture, the base reacting with the POSS fragments to produce the
5 POSS compound,

6 wherein the POSS fragments have the formula $(\text{RSiO}_{1.5})_m(\text{RXSiO}_{1.0})_n$ and contain from 1
7 to 7 silicon atoms and no more than 3 rings, and the POSS compound is selected from the group
8 consisting of homoleptic nanostructure compounds having the formula $[(\text{RSiO}_{1.5})_n]_{\Sigma\#}$,
9 heteroleptic nanostructure compounds having the formula $[(\text{RSiO}_{1.5})_m(\text{R}'\text{SiO}_{1.5})_n]_{\Sigma\#}$,
10 functionalized homoleptic nanostructure compounds having the formula
11 $[(\text{RSiO}_{1.5})_m(\text{RXSiO}_{1.0})_n]_{\Sigma\#}$, functionalized heteroleptic nanostructure compounds having the
12 formula $[(\text{RSiO}_{1.5})_m(\text{R}'\text{SiO}_{1.5})_n(\text{RXSiO}_{1.0})_p]_{\Sigma\#}$, and expanded POSS fragments having the
13 formula $(\text{RSiO}_{1.5})_m(\text{RXSiO}_{1.0})_n$, where R and R' each represents an organic substituent, X
14 represents a functionality substituent, m, n and p represent the stoichiometry of the formula, Σ
15 indicates nanostructure, and # represents the number of silicon atoms contained within the
16 nanostructure.

1 47. (Previously presented) The process of claim 46, wherein the base and the POSS
2 fragments are mixed by stirring the reaction mixture.

1 48. (Previously presented) The process of claim 46, further comprising the steps of:
2 heating the reaction mixture to reflux; and
3 cooling the reaction mixture to room temperature.

1 49. (Previously presented) The process of claim 48, further comprising:
2 isolating the POSS compound.

1 50. (Previously presented) The process of claim 49 wherein the POSS compound is isolated
2 by distillation, filtration, evaporation, decantation, crystallization, pressure reduction, or
3 extraction, or a combination thereof.

1 51. (Previously presented) The process of claim 50, further comprising the step of purifying
2 the isolated POSS compound through washing with water.

1 52. (Previously presented) The process of claim 46, wherein the base cleaves at least one
2 silicon-oxygen-silicon (Si-O-Si) bond in the POSS fragments to promote the conversion of the
3 POSS fragments into the POSS compound.

1 53. (Currently amended) The process of claim 52, wherein the base is selected from the
2 group consisting of hydroxide, organic alkoxides, carboxylates, amides, carboxamides,
3 carbanions, carbonate, sulfate, phosphate, biphosphate, phosphorus ylides, nitrate, borate,
4 cyanate, fluoride, hypochlorite, silicate, stannate, Al_2O_3 , CaO, and ZnO, amines, amine oxides,
5 lithium organometallics, zinc organometallics, and magnesium organometallics. ~~hydroxide $[\text{OH}]^-$~~
6 ~~, organic alkoxides $[\text{R}''\text{O}]^-$, carboxylates $[\text{R}''\text{COO}]^-$, amides $[\text{R}''\text{NH}]^-$, carboxamides~~
7 ~~$[\text{R}''\text{C}(\text{O})\text{NR}'']^-$, carbanions $[\text{R}'']^-$, carbonate $[\text{CO}_3]^{2-}$, sulfate $[\text{SO}_4]^{2-}$, phosphate $[\text{PO}_4]^{3-}$,~~
8 ~~biphosphate $[\text{HPO}_4]^{2-}$, phosphorus ylides $[\text{R}''_4\text{P}]^-$, nitrate $[\text{NO}_3]^-$, borate $[\text{B}(\text{OH})_4]^-$, cyanate~~
9 ~~$[\text{OCN}]^-$, fluoride $[\text{F}]^-$, hypochlorite $[\text{OCl}]^-$, silicate $[\text{SiO}_4]^{4-}$, stannate $[\text{SnO}_4]^{4-}$, basic metal oxides~~
10 ~~comprising Al_2O_3 , CaO, and ZnO, amines $\text{R}''_3\text{N}$ and amine oxides $\text{R}''_3\text{NO}$, and organometallics~~
11 ~~comprising $\text{R}''\text{Li}$, $\text{R}''_2\text{Zn}$, $\text{R}''_2\text{Mg}$, and $\text{R}''\text{MgX}'$, where R'' represents an organic substituent and~~
12 ~~multiple organic substituents need not be identical, and X' represents an inorganic substituent.~~

1 54. (Previously presented) The process of claim 53, wherein the concentration of the base is
2 between 1-10 equivalents per mole of silicon present in the reaction mixture.

1 55. (Previously presented) The process of claim 54, wherein the concentration of the
2 hydroxide base is between 1-2 equivalents per mole of silicon present in the reaction mixture.

1 56. (Previously presented) The process of claim 46, wherein a mixture of different bases is
2 used.

1 57. (Previously presented) The process of claim 46, further comprising mixing a co-reagent
2 with the base and the plurality of POSS fragments in the solvent.

1 58. (Currently amended) The process of claim 47, wherein the co-reagent is selected from the
2 group consisting of common Grignard reagents, $R''MgX'$, alkali halides, zinc compounds
3 comprising ZnI_2 , $ZnBr_2$, $ZnCl_2$, and ZnF_2 , aluminum compounds comprising Al_2H_6 , $LiAlH_4$,
4 AlI_3 , $AlBr_3$, $AlCl_3$, and AlF_3 , and boron compounds comprising dihydroxy-organoborons,
5 $R''B(OH)_2$, BI_3 , BBr_3 , BCl_3 , and BF_3 , ~~where R'' represents an organic substituent and X'~~
6 ~~represents an inorganic substituent.~~

1 59. (Previously presented) A process of converting a first functionalized POSS
2 nanostructure compound into a second functionalized POSS nanostructure compound that is
3 different than the first functionalized POSS nanostructure compound, comprising:

4 mixing an effective amount of a base with the first functionalized POSS nanostructure
5 compound in a solvent to produce a basic reaction mixture, the base reacting with the first
6 functionalized POSS nanostructure compound to produce the second POSS nanostructure
7 compound,

8 wherein the first and second POSS nanostructure compounds are each selected from the
9 group consisting of homoleptic nanostructure compounds having the formula $[(RSiO_{1.5})_n]_{\Sigma\#}$,
10 heteroleptic nanostructure compounds having the formula $[(RSiO_{1.5})_m(R'SiO_{1.5})_n]_{\Sigma\#}$,
11 functionalized homoleptic nanostructure compounds having the formula
12 $[(RSiO_{1.5})_m(RXS_iO_{1.0})_n]_{\Sigma\#}$, and functionalized heteroleptic nanostructure compounds having the
13 formula $[(RSiO_{1.5})_m(R'SiO_{1.5})_n(RXS_iO_{1.0})_p]_{\Sigma\#}$, where R and R' each represents an organic
14 substituent, X represents a functionality substituent, m, n and p represent the stoichiometry of the
15 formula, Σ indicates nanostructure, and # represents the number of silicon atoms contained
16 within the nanostructure.

1 60. (Previously presented) The process of claim 59, wherein the second functionalized POSS
2 nanostructure compound has more functionalities X than the first functionalized POSS
3 nanostructure compound but the two functionalized POSS nanostructure compounds have the
4 same number of silicon atoms.

1 61. (Previously presented) The process of claim 59, wherein the base and the first
2 functionalized POSS nanostructure compound are mixed by stirring the reaction mixture.

1 62. (Previously presented) The process of claim 61, further comprising the steps of:
2 heating the reaction mixture to reflux; and
3 cooling the reaction mixture to room temperature.

1 63. (Previously presented) The process of claim 62, further comprising:
2 isolating the second functionalized POSS nanostructure compound.

1 64. (Previously presented) The process of claim 63, wherein the second functionalized POSS
2 nanostructure compound is isolated by distillation, filtration, evaporation, decantation,
3 crystallization, pressure reduction, or extraction, or a combination thereof.

1 65. (Previously presented) The process of claim 64, further comprising the step of purifying
2 the isolated POSS nanostructure compound through washing with water.

1 66. (Previously presented) The process of claim 59, wherein the base cleaves at least one
2 silicon-oxygen-silicon (Si-O-Si) bond in the first functionalized POSS nanostructure compound
3 to promote the conversion of the first functionalized POSS nanostructure compound into the
4 second functionalized POSS nanostructure compound.

1 67. (Currently amended) The process of claim 66, wherein the base is selected from the
2 group consisting of hydroxide, organic alkoxides, carboxylates, amides, carboxamides,
3 carbanions, carbonate, sulfate, phosphate, biphosphate, phosphorus ylides, nitrate, borate,
4 cyanate, fluoride, hypochlorite, silicate, stannate, Al₂O₃, CaO, and ZnO, amines, amine oxides,

5 ~~lithium organometallics, zinc organometallics, and magnesium organometallics. hydroxide [OH]⁻~~
6 ~~, organic alkoxides [R''O]⁻, carboxylates [R''COO]⁻, amides [R''NH]⁻, carboxamides~~
7 ~~[R''C(O)NR'']⁻, carbanions [R'']⁻, carbonate [CO₃]⁻², sulfate [SO₄]⁻², phosphate [PO₄]⁻³,~~
8 ~~biphosphate [HPO₄]⁻², phosphorus ylides [R''₄P]⁻, nitrate [NO₃]⁻, borate [B(OH)₄]⁻, cyanate~~
9 ~~[OCN]⁻, fluoride [F]⁻, hypochlorite [OCl]⁻, silicate [SiO₄]⁻⁴, stannate [SnO₄]⁻⁴, basic metal oxides~~
10 ~~comprising Al₂O₃, CaO, and ZnO, amines R''₃N and amine oxides R''₃NO, and organometallics~~
11 ~~comprising R''Li, R''₂Zn, R''₂Mg, and R''MgX', where R'' represents an organic substituent and~~
12 ~~multiple organic substituents need not be identical, and X' represents an inorganic substituent.~~

1 68. (Previously presented) The process of claim 67, wherein the base is a hydroxide and the
2 concentration of the hydroxide base is between 1-10 equivalents per mole of silicon present in
3 the reaction mixture.

1 69. (Previously presented) The process of 68, wherein the concentration of the hydroxide
2 base is between 2-5 equivalents per mole of silicon present in the reaction mixture.

1 70. (Previously presented) The process of claim 59, wherein a mixture of different bases is
2 used.

1 71. (Previously presented) The process of claim 59, further comprising mixing a co-reagent
2 with the base and the first functionalized POSS nanostructure compound in the solvent.

1 72. (Currently amended) The process of claim 71, wherein the co-reagent is selected from the
2 group consisting of common Grignard reagents, R''MgX', alkali halides, zinc compounds
3 comprising ZnI₂, ZnBr₂, ZnCl₂, and ZnF₂, aluminum compounds comprising Al₂H₆, LiAlH₄,
4 AlI₃, AlBr₃, AlCl₃, and AlF₃, and boron compounds comprising dihydroxy-organoborons,
5 R''B(OH)₂, BI₃, BBr₃, BCl₃, and BF₃, ~~where R'' represents an organic substituent and X'~~
6 ~~represents an inorganic substituent.~~

Claims 73-85 (Cancelled).

1 86. (Previously presented) A process of converting an unfunctionalized POSS nanostructure
2 compound into a functionalized POSS nanostructure compound, comprising:

3 mixing an effective amount of a base with the unfunctionalized POSS nanostructure
4 compound in a solvent to produce a basic reaction mixture, the base reacting with the
5 unfunctionalized POSS nanostructure compound to produce the functionalized POSS
6 nanostructure compound,

7 wherein the unfunctionalized POSS nanostructure compound is selected from the group
8 consisting of homoleptic nanostructure compounds having the formula $[(\text{RSiO}_{1.5})_n]_{\Sigma\#}$ and
9 heteroleptic nanostructure compounds having the formula $[(\text{RSiO}_{1.5})_m(\text{R}'\text{SiO}_{1.5})_n]_{\Sigma\#}$, and the
10 functionalized POSS nanostructure compound is selected from the group consisting of
11 functionalized homoleptic nanostructure compounds having the formula
12 $[(\text{RSiO}_{1.5})_m(\text{RXSiO}_{1.0})_n]_{\Sigma\#}$ and functionalized heteroleptic nanostructure compounds having the
13 formula $[(\text{RSiO}_{1.5})_m(\text{R}'\text{SiO}_{1.5})_n(\text{RXSiO}_{1.0})_p]_{\Sigma\#}$, where R and R' each represents an organic
14 substituent, X represents a functionality substituent, m, n and p represent the stoichiometry of the
15 formula, Σ indicates nanostructure, and # represents the number of silicon atoms contained
16 within the nanostructure.

1 87. (Previously presented) The process of claim 86, wherein the base and the
2 unfunctionalized POSS nanostructure compound are mixed by stirring the reaction mixture.

1 88. (Previously presented) The process of claim 86, further comprising the steps of:

2 heating the reaction mixture to reflux; and

3 cooling the reaction mixture to room temperature.

1 89. (Previously presented) The process of claim 88, further comprising:

2 isolating the functionalized POSS nanostructure compound.

1 90. (Previously presented) The process of claim 89, wherein the functionalized POSS
2 nanostructure compound is isolated by distillation, filtration, evaporation, decantation,
3 crystallization, pressure reduction, or extraction, or a combination thereof.

1 91. (Previously presented) The process of claim 90, further comprising the step of purifying
2 the isolated functionalized POSS nanostructure compound through washing with water.

1 92. (Previously presented) The process of claim 86, wherein the base cleaves at least one
2 silicon-oxygen-silicon (Si-O-Si) bond in the unfunctionalized POSS nanostructure compound to
3 promote the conversion of the polymeric silsesquioxane into the functionalized POSS
4 nanostructure compound.

1 93. (Currently amended) The process of claim 52, wherein the base is selected from the
2 group consisting of hydroxide, organic alkoxides, carboxylates, amides, carboxamides,
3 carbanions, carbonate, sulfate, phosphate, biphosphate, phosphorus ylides, nitrate, borate,
4 cyanate, fluoride, hypochlorite, silicate, stannate, Al_2O_3 , CaO, and ZnO, amines, amine oxides,
5 lithium organometallics, zinc organometallics, and magnesium organometallics, hydroxide $[\text{OH}]^-$
6 , organic alkoxides $[\text{R}''\text{O}]^-$, carboxylates $[\text{R}''\text{COO}]^-$, amides $[\text{R}''\text{NH}]^-$, carboxamides
7 $[\text{R}''\text{C}(\text{O})\text{NR}'']^-$, carbanions $[\text{R}'']^-$, carbonate $[\text{CO}_3]^{2-}$, sulfate $[\text{SO}_4]^{2-}$, phosphate $[\text{PO}_4]^{3-}$,
8 biphosphate $[\text{HPO}_4]^{2-}$, phosphorus ylides $[\text{R}''_4\text{P}]^-$, nitrate $[\text{NO}_3]^-$, borate $[\text{B}(\text{OH})_4]^-$, cyanate
9 $[\text{OCN}]^-$, fluoride $[\text{F}]^-$, hypochlorite $[\text{OCl}]^-$, silicate $[\text{SiO}_4]^{4-}$, stannate $[\text{SnO}_4]^{4-}$, basic metal oxides
10 comprising Al_2O_3 , CaO, and ZnO, amines $\text{R}''_3\text{N}$ and amine oxides $\text{R}''_3\text{NO}$, and organometallics
11 comprising $\text{R}''\text{Li}$, $\text{R}''_2\text{Zn}$, $\text{R}''_2\text{Mg}$, and $\text{R}''\text{MgX}'$, where R'' represents an organic substituent and
12 multiple organic substituents need not be identical, and X' represents an inorganic substituent.

1 94. (Previously presented) The process of claim 93, wherein the base is a hydroxide and the
2 concentration of the hydroxide base is between 1-10 equivalents per mole of silicon present in
3 the reaction mixture.

1 95. (Previously presented) The process of claim 94, wherein the concentration of the
2 hydroxide base is between 2-5 equivalents per mole of silicon present in the reaction mixture.

1 96. (Previously presented) The process of claim 95, wherein a mixture of different bases is
2 used.

1 97. (Previously presented) The process of claim 86, further comprising mixing a co-reagent
2 with the base and the unfunctionalized POSS nanostructure compound in the solvent.

1 98. (Currently amended) The process of claim 97, wherein the co-reagent is selected from the
2 group consisting of common Grignard reagents, $R''MgX'$, alkali halides, zinc compounds
3 comprising ZnI_2 , $ZnBr_2$, $ZnCl_2$, and ZnF_2 , aluminum compounds comprising Al_2H_6 , $LiAlH_4$,
4 AlI_3 , $AlBr_3$, $AlCl_3$, and AlF_3 , and boron compounds comprising dihydroxy-organoborons,
5 $R''B(OH)_2$, BI_3 , BBr_3 , BCl_3 , and BF_3 , ~~where R'' represents an organic substituent and X'~~
6 ~~represents an inorganic substituent.~~

99-113 (Cancelled).

1 114. (Previously amended) A process of converting a polymeric silsesquioxane into a POSS
2 nanostructure compound, comprising:

3 mixing an effective amount of a base with the polymeric silsesquioxane in a solvent to
4 produce a basic reaction mixture, the base reacting with the polymeric silsesquioxane to produce
5 the POSS nanostructure compound,

6 wherein the polymeric silsesquioxane has the formula $[RSiO_{1.5}]_\infty$, and the POSS
7 nanostructure compound is $[(RSiO_{1.5})_4(RXSiO_{1.0})_3]_{\Sigma 7}$, where R represents an organic substituent,
8 X represents a functionality substituent, ∞ represents the degree of polymerization and is a
9 number greater than or equal to 1, and Σ indicates nanostructure.

1 115. (Currently amended) The process of claim 46, wherein the POSS compound is
2 $[(RSiO_{1.5})_4(RXSiO_{1.0})_3]_{\Sigma 7}$. ~~$[RSiO_{1.5})_4(RXSiO_{1.0})_3]_{\Sigma 7}$~~

1 116. (Previously presented) The process of claim 59, wherein the second functionalized POSS
2 nanostructure compound is $[(RSiO_{1.5})_4(RXSiO_{1.0})_3]_{\Sigma 7}$.

117. (Cancelled).

1 , 118. (Previously presented) The process of claim 86, wherein the functionalized POSS
2 nanostructure compound is $[(\text{RSiO}_{1.5})_4(\text{RXSiO}_{1.0})_3]_{\Sigma 7}$.

119-134. (Cancelled).